3.2 SOILS

This section identifies the existing soil characteristics in the study area and describes the potential impacts of the project, as well as mitigation measures to reduce these impacts.

3.2.1 AREA OF ANALYSIS AND METHODOLOGY

This section addresses soils within the study corridor and discusses the potential constraints posed by soils during construction, operation, and maintenance of the Falcon to Gonder project. The area of analysis for soil resources consists of a 500-foot-wide corridor (250 feet on each side of the centerline) along the five route alternatives.

The term "soil" has many definitions. Soil scientists usually consider soil as any medium for plant growth. As used in this report, soil is defined as a natural body consisting of layers or horizons of minerals and/or organic constituents of variable thickness, which differ from the parent material in their morphological, physical, chemical, and mineralogical properties as well as their biological characteristics. Topography, or local relief, controls much of the distribution of soils in the landscape, to such an extent that soils of markedly contrasting morphologies and properties can merge laterally with one another and yet be in equilibrium under existing local conditions (Birkeland 1984).

The primary source of information for soils within the project area was obtained from the Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) of the U.S. Department of Agriculture (USDA). Both published and digital soil survey maps (Soil Survey Geographic [SSURGO] Database) were available for the study corridor. The soil surveys applicable to the project study area include the following:

- Soil Survey of Diamond Valley Area, Nevada (NRCS 1980a);
- Soil Survey of Tuscadora Mountain Area, Nevada (NRCS 1980b);
- Soil Survey of Elko County Area, Nevada Central Part (NRCS 1997);
- Soil Survey of Eureka County Area, Nevada (NRCS 1989);
- Soil Survey of Lander County Area, Nevada North Part (NRCS 1992); and
- Soil Survey of Western White Pine County Area, Nevada (NRCS 1998).

The NRCS has mapped and delineated soils within the project area into soil series and soil map units. According to the NRCS, the objective of soil mapping is not to delineate pure taxonomic classes but to separate the landscape into segments with similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, on-site investigations may be needed to precisely define and locate the soils and miscellaneous areas. Most of the mapped areas within the soil surveys generally represent associations of two or three soil components (NRCS 1997).

Soils within the study corridor were analyzed based on seven soil constraint factors (high water erosion hazard, steep slopes, shallow depth to bedrock, high water table, coarse to very coarse soil texture, salinity/alkalinity problems, and high shrink/swell potential), which are relevant in assessing potential construction impacts and reclamation after construction. These major climatic, biological, physical, and chemical constraints for soils within the study area were collected from NRCS soil descriptions and soil management characteristics. To compare relative potential impact quantities among route alternative segments, the soil constraint groups occurring along the transmission line centerline and substation facilities were quantified in linear miles. Soils were not quantified along existing access roads to be improved as part of the project, spur roads to be constructed, nor staging areas, since the exact locations of these appurtenant facilities are unknown at this time. The characteristics of soils along new spur roads and existing access roads are within the range of soil characteristics and constraints found in the study corridor.

Major Land Resource Area (MLRA) descriptions (NRCS Areas 24, 25, 28B) for the Humboldt, Owyhee High Plateau, and Central Nevada Basin and Range were used together with Ecological Status Inventory (ESI) data from the BLM's Elko, Ely, and Battle Mountain Field Offices to identify plant community types that can occur within a soil or ecological site complex in the project area. A list of MLRA Range Sites, including correlated plant community types, potentially found in the project area is included as Appendix 1 in the SEI and Tetra Tech EMI (2000), Vegetation Survey report. Plant community types are described in Section 3.4, Vegetation.

REGULATORY FRAMEWORK

National Pollutant Discharge Elimination System Permit

The NDEP administers the federal EPA promulgated regulations (55 CFR 47990) requiring the permitting of stormwater-generated pollution under the National Pollutant Discharge Elimination System (NPDES). Pursuant to these federal regulations, an operator must obtain a General Permit under the NPDES Stormwater Program for all construction activities of 5 acres or greater. The General Permit requires the implementation of Best Management Practices (BMPs) to reduce pollutant loads into the waters of the state.

Nevada Best Management Practices (BMPs)

The use of BMPs in Nevada is addressed in the Handbook of Best Management Practices published by the State of Nevada Environmental Commission (1994). The handbook references two definitions of BMPs. EPA guidelines define BMPs as "methods, measures, or practices to prevent or reduce water pollution, including but not limited to, structural and non-structural controls, operation and maintenance procedures and scheduling and distribution of activities. Usually BMPs are applied as a system of practices rather than a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility." Nevada Administrative Code 445.200 defines "Best Practices" as "measures, methods, or operation or practice that are reasonably designed to prevent, eliminate, or reduce water pollution from diffuse sources and that are consistent with the best practices in the particular field under the conditions applicable. This term is intended to be equivalent to the term 'best management practices' as used in federal statures and regulations."

3.2.2 AFFECTED ENVIRONMENT

GEOLOGIC HISTORY

The landscape of the Basin and Range province is dominated by isolated mountain ranges rising abruptly from broad, alluvium-filled desert basins that include erosional stream valleys and dissected plateaus.

The general term "alluvial plains" has been used to broadly encompass the entire piedmont slope and basin floor, with the exception of the playa. The basin floors and piedmont slopes are complex, but the mountain fronts may be deeply embayed by alluvium-filled valleys, some of which open into intramontane basins. These mountain valleys contain landforms similar to those of the great piedmont slopes.

The piedmont slopes are largely comprised of a few major landforms—mountain valley fans, fan piedmonts, alluvial fans, and alluvial plains—that were largely constructed during the Pleistocene time or earlier. Since about mid-Pleistocene time, these particular landforms have been modified by recurrent erosion and deposition cycles, separated by periods of stability and soil formation. Only parts of these major landforms were cut away by periodic erosion or buried by periodic sedimentation during each of the cycles. Thereby, smaller component landforms, their landform elements, and their slope components have created these major landforms. This resulted in a mosaic of old, remnant land surfaces and relatively young land surfaces that more nearly accord with individual soils than these major landforms. Several other landforms, including ballenas, fan skirts, beach plains, and playas, were themselves created by the cycles of erosion and deposition. They have been left largely intact by the latest cycles so that they also accord fairly well with soils.

SOIL CHARACTERISTICS

Soil survey mapping generally organizes soils into soil series and soil map units. The soil series is the lowest category of the national soil classification system and is the most homogeneous class in the system of taxonomy. The name of a soil series is the common reference term, used to name soil map units. Soil map units typically represent associations of two or three major soil components, as well as inclusionary soils. Soil patterns commonly coincide with landforms and physiographic positions but may occur across multiple features.

Palinor, Tenabo, Pineval, and Rubyhill soils are the predominant soil series occurring in the study area. Together, these soils occur on approximately 75 miles of the transmission centerline, or roughly 20% of the study area. A brief description of the predominant soil series is provided below. Other soil types in the study area are detailed in a separate Technical Memorandum (EDAW 2001).

Palinor Series

The Palinor series consists of well-drained soils formed in alluvium dominantly from limestone and other calcareous sources. They typically have moderate permeability, an available water capacity of 1 to 4 inches, and a low to moderate shrink-swell potential. Palinor series soils are shallow, with a depth to duripan of 14 to 20 inches and a depth to seasonal high water table of more than 60 inches. Slopes vary from 2 to 50%; thus, runoff ranges from slow to rapid. The hazard of water erosion is slight to moderate, but there is only a slight wind erosion hazard. The content of rock fragments ranges from 45 to 75% pebbles and 0 to 5% cobbles. The dominant vegetation is mainly black sagebrush, bottlebrush squirreltail, spiny hopsage, and ephedra. Soil map units in the study area that are characterized by Palinor series soils include "Palinor very gravelly loam, 2 to 15% slopes," and "Palinor-Urmafoot-Palinor, steep association." Palinor series soils are generally found in the White River Valley of White Pine County, Nevada.

Tenabo Series

The Tenabo series consists of well-drained soils that are formed in a thin loess mantle high in volcanic ash over alluvium from mixed rocks. They typically have moderately slow permeability, a low available water capacity, and a low to moderate shrink-swell potential. Tenabo series soils are shallow with a depth to duripan of 9 to 20 inches and a depth to seasonal high water table of more than 20 inches. Slopes vary from 0 to 30%; thus, runoff ranges from very slow to medium. However, some map units do have rapid runoff. The hazard of water erosion varies from slight to high, but there is only a slight wind erosion hazard. The content of rock fragments is less than 20%, when mixed. The dominant vegetation is mainly shadscale, bud sagebrush, cheatgrass, bottlebrush squirreltail, and Sandberg's bluegrass. Soil map units in the study area characterized by Tenabo series soils include "Tenabo cobbly silt loam, 2 to 15% slopes," "Tenabo association," and "Tenabo-Ricert association." Tenabo series soils are generally found in the near the town of Beowawe in Eureka County, Nevada.

Pineval Series

The Pineval series consists of well-drained soils that formed in alluvium derived from volcanic or mixed rocks. They typically have moderately slow permeability, a low available water capacity (up to 12.6 inches due to soil association), and a low shrink-swell potential. Pineval series soils are very deep with a depth to seasonal high water table of more than 60 inches. Slopes vary from 2 to 30%; thus, runoff ranges from medium to very rapid. The hazard of water and wind erosion are both slight. The content of rock fragments range is 35 to 60% pebbles. The dominant vegetation is mainly Wyoming big sagebrush, Douglas rabbitbrush, Thurber's needlegrass, Sandberg's bluegrass, and bottlebrush sqirreltail. Soil map units in the study area characterized by Pineval series soils include "Pineval-Tulase-Perwick association." Pineval series soils are generally found south of the town of Carlin in Elko County, Nevada.

Rubyhill Series

The Rubyhill series consists of well-drained soils that formed in alluvium from mixed rock sources. They typically have moderate permeability and a low available water capacity. Rubyhill series soils are moderately deep with an effective rooting depth and depth to duripan of 20 to 30 inches. Slopes vary from 0 to 8%; thus, runoff is slow to medium. The hazard of erosion is slight. The content of rock fragments range from 5 to 35% gravel. The dominant vegetation is mainly big sagebrush, Sandberg's bluegrass, and occasionally pinyon and juniper. Soil map units in the study area that are characterized by Rubyhill series soils include "Rubyhill fine sandy loam, 2 to 8% slopes." Rubyhill series soils are found in the Kobeh Valley of Eureka County, Nevada.

3.2.3 ENVIRONMENTAL CONSEQUENCES

This section contains a discussion of the potential impacts of the project as it relates to soil resources and reclamation/revegetation suitability; also provided are mitigation measures to reduce these impacts to a less-than-significant level. The significance criteria for assessing impacts are described below.

SIGNIFICANCE CRITERIA

For the purpose of this EIS, project construction, operation, and maintenance activities would have a significant impact to soils and reclamation/revegetation efforts if they would:

- Substantially increase erosion along the transmission line corridor, access and spur roads, or around associated facilities;
- Substantially affect downstream resources by erosion and sedimentation;
- Substantially increase soil compaction; and/or
- Substantially decrease the potential or time period for revegetation/reclamation success.

SOIL CONSTRAINT GROUPS

Seven soil constraint groups were established to identify soils that may impede construction, operation, maintenance, and reclamation activities associated with the project. These soil groups are described below. A detailed table of soil constraints by soil series and soil map unit is contained in a Technical Memorandum (EDAW 2001), available at the Elko, Ely, and Battle Mountain BLM field offices. Approximately 29% of the study corridor is generally free of any of soil constraints (see Figures 3.2-1 and 3.2-2). However, soils generally free of constraints still may possess small problem areas that could impede reclamation or other project activities. Such areas will be identified prior to construction and reclamation, and included in the COM Plan.

FIGURE 3.2-1 AREAS WITH NO RECLAMATION CONSTRAINTS

FIGURE 3.2-2 AREAS WITH STEEP SLOPES AND HIGH WATER ERODIBILITY

Group 1 - High Water Erodibility

Erosion factors are used to predict the erodibility of soils and its tolerance to erosion when subject to certain kinds of construction activities and land uses. The water erosion factor was utilized to evaluate the soils within the project area. According to the NRCS, most soils in the project area are not subject to high wind erosion (personal communication with Tom McKay, NRCS, June 2000). Based on NRCS recommendations for calculating erosion potential in Nevada, the water erosion potential of a given soil map unit was calculated as the product of the "K" factor, or the "soil erodibility index" and the percent slope (personal communication with Tom McKay, NRCS, June 2000). Based on NRCS established ratings, water erosion potential was considered to be high if it was greater than 8 (personal communication with Tom McKay, NRCS, June 2000). Soils with a high water erosion potential are characterized by steep slopes, rapid water runoff, exposed rock, sparse vegetation, and noncohesive materials easily transported by water. Soils with a high water erosion hazard rating occur over approximately 9.4% of the study corridor (see Figures 3.2-1 and 3.2-2). The most common soil series exhibiting severe water erosion hazard are Pookaloo, Hopeka, Toeja, Bartine, Atrypa, Creva, Bucan, and Malpais. Additionally, soils in recently burned areas (see Figure 3.4-1 in Section 3.4, Vegetation) have increased erosion potential until vegetative cover is re-established. Fire can also change the chemical structure of some soils, causing them to crystallize and making revegetation more difficult.

Group 2 - Steep Slopes

Slopes greater than 15% are considered moderately steep and could present problems during revegetation (e.g., poor seed retention or insufficient soil moisture). Steep slopes are generally associated with shallow soils in mountainous areas. Soils with a slope greater than 15% occur over approximately 28.1% of the study corridor (see Figures 3.2-1 and 3.2-2). The most common soil series exhibiting steep slopes are Pookaloo, Segura, Atlow, Tenabo, Atrypa, Hopeka, Toeja, Bucan, Cyan, and Perwick.

Group 3 - Shallow Depth to Bedrock

Bedrock is the solid material that underlies the soil and other unconsolidated material. Soils with shallow bedrock are defined as those where bedrock is located within 15 inches of the soil surface. This soil characteristic occurs over approximately 16.5% of the study corridor. It is generally associated with less developed soils in the mountainous areas. The most common soil series exhibiting a shallow depth to bedrock are Pookaloo, Segura, Atlow, Atrypa, Hopeka, Genaw, Chen, Upatad, Tecomar, and Creva.

Group 4 - High Water Table

Soils with a high water table are characterized by a water table typically within 6 feet of the soil surface. Soils with a high water table can be subject to deep rutting and compaction by construction activities when wet. High water tables are generally associated with soils in the alluvial valleys. This soil characteristic occurs over approximately 2.1% of the study corridor. The most common soil series exhibiting a high water table is Ocala.

Group 5 – Coarse to Very Coarse Soil Texture

Soils with coarse to very coarse textures are those that include 15 to 35% by volume of coarse fragments (with particle size $\geq$ 2 mm in diameter) including gravels, cobbles, and stones at the surface or within the soil profile. Soils with coarse to very coarse soil textures can be a constraint to revegetation efforts due to insufficient soil moisture. These soils are generally associated with soils in alluvial valleys and footslopes of the mountain range areas. This soil characteristic occurs over approximately 56.8% of the study corridor. The most common soil series exhibiting coarse to very coarse soil texture are Palinor, Tenabo, Pineval, Perwick, Pookaloo, Yody, Segura, Atlow, Ratto, and Whirlo.

Group 6 - Salinity or Alkalinity Problems

Both saline and alkaline soils can stunt plant growth. A saline soil contains soluble salts in amounts that could impair the growth of plants. It is generally associated with soils in the alluvial valley areas. Saline soils occur over approximately 8% of the study corridor. The most common soil series exhibiting salinity problems are Ocala, Batan, Sheffit, Beowawe, Dunphy, Broyles, Wholan, and Rosney. An alkaline soil has a high degree of alkalinity (pH 8.5 or higher) and/or a high percentage of exchangeable sodium (15% or more of the total exchangeable bases). Alkaline soils occur over approximately 5% of the study corridor. The most common soil series exhibiting alkalinity problems are Ocala, Alhambra, Sheffit, and Dunphy.

Group 7 – High Shrink/Swell Potential

Soils with a high shrink/swell potential are characterized by a high clay content (greater than 40%) in the subsoil. These soils are prone to swelling when wet and shrinking when drying out. Soils with a moderate to high shrink/swell potential may create soil stability and drainage problems. Typically, these soils form deep cracks after drying out and have a greater potential for drainage problems and soil stability. This would primarily be a constraint during construction and revegetation activities within the project area. Soils with a moderate to high shrink/swell potential are generally found in alluvial valleys and footslopes of the mountains. Soils with a moderate shrink/swell potential occur over approximately 13.9% of the study corridor. The most common soil series exhibiting moderate shrink/swell potential are Ocala, Segura, Ratto, Atrypa, Bartine, Alhambra, Hodedo, Sheffit, Mau, and Coils.

ENVIRONMENTAL IMPACTS - COMPARISON OF ALTERNATIVES

Impacts Common to all Route Alternatives

The general construction, operation, and maintenance effects of the project on soil erosion and reclamation/revegetation efforts are related to efforts on other resources, such as vegetation resources, wildlife habitat, special status animal and plant species, and range resources. Construction, operation, and maintenance activities could result in substantial soil erosion and decrease the success of reclamation/revegetation through the following ground-disturbing activities:

- Excavation for towers and anchors;
- Blading and grading of soil for construction access and work areas at tower structure locations;
- Construction of new spur roads and improvement of existing access roads;
- Temporary stockpiling of soil or construction materials and sidecasting of soil and vegetation;
- Use of designated equipment staging areas;
- Soil compaction and dust; and/or
- Equipment access through nonsensitive stream channels (defined as streams that do not support sensitive species, critical habitat, or woody riparian vegetation).

Table 3.2-1 summarizes the characteristics of the seven soil groups discussed above in terms of potential project-related impacts and constraints. The following is an analysis of potential soil-related impacts common to all route alternatives (i.e., irrespective of segment or alternative), as well as mitigation measures that would reduce these impacts to a less-than-significant level. An analysis of soil groups occurring within each of the route alternatives follows.

❑ ***Impact Soil-1: Increased Soil Compaction and Rutting in the Transmission Line Corridor and Around Substations During Construction, Operation, and Maintenance of the Project***

Soils with a high water table and high clay content are susceptible to deep rutting and compaction by vehicles and heavy equipment when wet. Soils with a high clay content are also susceptible to deep crack formation along created ruts when soils dry out. Compacted, rutted, or cracked soils can hinder or delay re-establishment of vegetation and success in reclamation objectives. Because the extent of this impact is expected to be limited, this impact is considered adverse but less-than-significant. However, implementation of the following mitigation measure would reduce the effects to these soil constraint groups.

TABLE 3.2-1: POTENTIAL PROJECT-RELATED IMPACTS OF THE SOIL GROUPS ANALYZED

Soil Constraint Group	Stage of Project	Potential Impacts/ Constraints
High Water Erodibility	Construction, Operation, Maintenance, Reclamation	Loss of topsoil and sedimentation of downstream resources.
Steep Slope	Reclamation	Insufficient water availability to the root zone and difficult to retain seeds on slope.
Shallow Bedrock	Reclamation	Plant rooting depth and available water may be restricted.
High Water Table	Construction, Operation, Maintenance, Reclamation	Deep rutting and compaction from equipment.
Coarse to Very Coarse Soil Texture	Reclamation	Poor water retention for seed germination and plant establishment.
Saline/Alkaline Soils	Reclamation	Low water nutrient availability to plants, which could result in plants with stunted roots and withered leaves.
High Shrink/Swell Potential	Construction, Operation and Maintenance	Soil stability and drainage problems.

❑ ***Mitigation Measure Soil-1***

Construction, operation, and maintenance activities will be restricted when the soil is too wet to adequately support construction or maintenance equipment (i.e., when heavy equipment creates ruts in excess of 4 inches deep over a distance of 100 feet or more in wet or saturated soils). This standard would not apply in areas with silty soils, which easily form depressions even in dry weather. Where the soil is deemed too wet, one or more of the following measures would apply:

(a) When feasible, re-route all construction or maintenance activities around the wet areas so long as the route does not cross into sensitive resource areas.

(b) If wet areas cannot be avoided, implement BMPs for use in these areas during construction and improvement of access roads, and their subsequent reclamation. This includes use of wide-track or balloon-tire vehicles and equipment, or other weight dispersing systems approved by the appropriate resource agencies. It also may include use of geotextile cushions, pre-fabricated equipment pads, and other materials to minimize damage to the substrate where determined necessary by resource specialists. If BMPs cannot be successfully applied to wet or saturated soil areas, construction or routine maintenance activities would not be allowed in these areas until the project environmental monitor(s) determine it is acceptable to proceed.

(c) Limit access of construction equipment to the minimum amount feasible, remove and separate topsoil in wet or saturated areas, and stabilize subsurface soils with a combination of one or more of the following: grading to dewater problem areas, utilize weight dispersion mats, and maintain erosion control measures such as surface rilling and back-dragging. After construction is complete, re-grade and re-contour the area, replace topsoil, and reseed to achieve the required plant densities.

(d) Compensate for increased impacts on soils: If equipment creates excessive ruts in wet or saturated soils as determined by the project environmental monitors, and these areas require supplemental dewatering, stabilization, erosion control, and reclamation measures to continue construction during wet conditions, increased impacts on soils and vegetation would be mitigated by restoration and preservation of disturbed soils and vegetation communities off-site. The restoration and/or preservation would take place off-site in the project area at a ratio to be determined in consultation with the BLM and SPPC. The final acreage for compensation would be determined by quantifying the post-construction disturbance area and condition. Even though it is not considered a significant impact, a compensation ratio of 1:1 off-site is proposed to mitigate for any increased permanent or temporary impacts to soils and vegetation related to continuing construction during wet conditions. This mitigation measure would be in addition to the on-site reclamation of the soil and vegetation disturbed by construction activities during wet conditions.

❑ *Impact Soil-2: Delayed or Reduced Reclamation Success Due to Project Activities on Coarse to Very Coarse Textured Soils, Alkaline/Saline Soils, or Soils with Shallow Depth to Bedrock*

Coarse to very coarse textured soils, soils with shallow depth to bedrock, and alkaline/saline soils have characteristics that could delay or reduce reclamation success along the transmission line corridor or around substations. Coarse to very coarse textured soils have a low water holding capacity. Under these conditions, successful seed germination may be difficult due to the lack of water in the soil profile. Soils with a shallow depth to bedrock typically have insufficient water availability and a restricted root zone within the soil profile. It may be difficult for shrub species to develop under these conditions. Alkaline/saline soils can hinder seed germination and are often too toxic for all but alkaline/saline-adapted plants. Plant communities adapted to these conditions are regionally abundant and the relative extent of impacts to these communities would be small. Therefore, this impact would be adverse but less-than-significant. However, the following mitigation measure would reduce the effects to these soil constraint groups.

❑ *Mitigation Measure Soil-2*

Vegetation removal and soil disturbances (including temporary road improvements) will be minimized in areas where soil constraints occur. Where vegetation removal is required, mowing or cutting will be the primary method utilized. Plants would generally be cut at a height that results in the least damage to the root crown during cutting or subsequent damage by vehicles and equipment. Blading will be restricted except when required for safe equipment operation (e.g., inability to operate a crane on a side hill). Previously located environmental constraint areas would be delineated in the field by a qualified resource specialist prior to construction and included in the COM Plan. These environmental constraint areas would then be avoided by construction activities, or mitigation would be applied consistent with measures described in this EIS.

❑ *Impact Soil-3: Construction on Expansive Soils (High Shrink/Swell Potential)*

Expansive soils (i.e., with a high shrink/swell potential) are scattered throughout the transmission line corridor. Structural foundations associated with the transmission lines would generally be below the 4-foot zone, which would not be affected by expansive soils. However, substation foundations could be significantly impacted by the presence of expansive soils. Geotechnical studies prepared for the project will identify areas of expansive soils. The implementation of the following mitigation measure would ensure that construction on expansive soils would result in a less-than-significant impact.

❑ ***Mitigation Measure Soil-3***

Prior to construction, soils will be evaluated to determine if they are expansive and if they may have potential effects on the proposed facilities. Where they represent a potential hazard, solutions recommended by the project's geotechnical engineer, such as excavation and replacement of the expansive soils with compacted backfill, would be required. If imported backfill material is used, it would be certified to be free of noxious weeds and propagules (i.e., seeds and root fragments).

❑ ***Impact Soil-4: Increased Soil Erosion in the Transmission Line Corridor and Associated Facilities During Construction, Operation, and Maintenance of the Project***

Construction of the project could result in surface disturbances and removal of vegetation along the transmission line corridor and around substation facilities, leading to increased soil erosion. Sedimentation into streams and water bodies would likely increase if disturbed soils were left exposed during winter, early spring, and summer storm events (periods of high precipitation, runoff, and winds). Erosion potential is generally more severe on steep, sparsely vegetated slopes, fine sandy or silty soils, and in loose sandy soils where strong winds occur. Erosion potential is also elevated in recently burned areas (i.e., 1999 or subsequently) so long as they remain largely unvegetated, especially in areas with high erosion potential. Soil erosion is expected to be minimal following successful reclamation of disturbed areas. Because the areas where erosion may be increased are narrow and spread over a large area, this impact would be less-than-significant. However, the following mitigation measure would reduce erosion impacts.

❑ ***Mitigation Measure Soil-4***

The objectives of this mitigation measure are to reduce short-term erosion and sedimentation, as well as quickly restore topography and vegetation to pre-construction conditions in all areas required and approved by BLM and private landowners. A qualified resource specialist would monitor implementation during construction and operations, until successful revegetation is achieved (see "Restoration Success Criteria" in Appendix E: Reclamation Plan). Monitoring of the erosion control measures would continue until reclamation efforts were considered complete and successful. Measures to be implemented by the project proponent during project construction and reclamation are listed below.

- Implementation of the following environmental protection practices would minimize the effects of grading, excavation, and other surface disturbances in all project areas. Schedules and specifications on the use of these features would be included in the COM plan.
  - Confine all vehicular traffic associated with construction to the 500-foot study corridor, material yards, wire set-up sites, access roads, and helicopter fly yards designated in the COM Plan.
  - Limit disturbance of soils and vegetation disturbance removal to the minimum area necessary for access and construction.
  - Where vegetation removal is necessary, use cutting/mowing methods instead of blading, wherever possible, as described in Mitigation Measure Soil-2.
  - Adhere to a construction methodology that mitigates impacts to less-than-significant levels in sensitive areas during severe weather events (see Mitigation Measure Soil-1).
  - Inform all construction personnel before they are allowed to work on the project of environmental concerns, pertinent laws and regulations, and elements of the erosion control plan. This could be presented in a multi-hour environmental training for

project management and general foremen, and a short (one hour or less) environmental training class for construction personnel.

- Minimize grading. When required, grading should be conducted away from watercourses to reduce the risk of material entering the watercourse.
- Graded material should be sloped and bermed where possible, to reduce surface water flows across the graded area.
- Replace excavated materials in disturbed areas and minimize the time between excavation and backfilling.
- Direct the dewatering of excavations onto stable surfaces to avoid soil erosion.
- Use detention basins, certified weed-free straw bales, or silt fences where appropriate.
- Use drainage control structures, where necessary, to direct surface drainage away from disturbance areas and to minimize runoff and sediment deposition downslope from all disturbed areas. These structures include culverts, ditches, water bars (berms and cross ditches), and sediment traps.
- Implement other applicable BMPs to minimize erosion-related impacts, during construction and improvement of access roads, and their subsequent reclamation.

• In areas of highly erodible soils, non-standard construction equipment and techniques that minimize surface disturbance, soil compaction, and loss of topsoil would be used, such as vehicles with low ground pressure tires, or helicopters when feasible and practicable. Vegetation clearing should be minimized. Temporary erosion control measures, in accordance with the Soil Conservation and Erosion Control Plan, will be installed before construction is allowed to proceed in potential soil erosion areas (e.g., steep slope areas). Erodible slopes that do not require grading should be cleared using equipment that results in little to no soil disturbance.
• Re-establish native and, if necessary, non-persistent, non-invasive, non-native vegetation cover in highly erodible areas as quickly as possible following construction.

Alternative-Specific Impacts

The following is an analysis of soil groups occurring within each of the route alternatives, potential soil-related impacts, and mitigation measures that would reduce these impacts, if significant, to a less-than-significant level. The linear miles of soil groups that occur along the proposed transmission line centerline and substation facilities are summarized by alternative in Table 3.2-2.

As evident in Table 3.2-2, there is very little distinction among the five alternatives based on soils-related constraints. The seven soils constraint groups occur to some degree in each of the five route alternatives; in most cases, the linear mileage associated with potential constraints is similar from alternative to alternative. In addition, there are no alternative- or segment-specific impacts (and associated mitigation measures) that occur; all soils impacts and related mitigation measures are addressed in impacts common to all route alternatives, as described in the previous section (Impact Soil-1 through -4). Because of these similarities, a segment-by-segment analysis is not warranted in the context of this EIS analysis; the subtle distinctions among the five route alternatives are described below.

TABLE 3.2-2: MILES OF SOIL CONSTRAINT GROUPS CROSSED BY THE TRANSMISSION LINE AND SUBSTATION

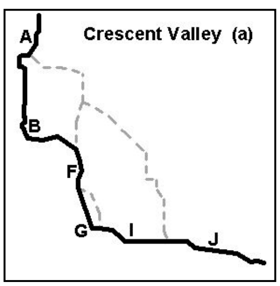
Route	Total Miles	No Reclamation Constraints	#1 High Water Erodibility	#2 Steep Slope	#3 Shallow Bedrock	#4 High Water Table	#5 Coarse to Very Coarse Soil Texture	#6a Saline Soils	#6b Alkaline Soils	#7 High Shrink/Swell Potential
Crescent Valley										
(a)	185.9	56.2	14.8	55.5	29.7	4.4	106.7	17.1	9.6	28.3
(b)	186.4	49.3	12.3	55.0	27.5	4.1	112.0	17.5	10.9	29.8
Pine Valley										
(a)	179.1	57.7	24.1	58.7	29.7	3.3	93.6	16.3	8.5	25.2
(b)	179.5	50.8	21.6	58.3	27.4	3.0	99.0	16.7	9.8	26.7
Buck Mountain										
	167.3	30.5	21.7	60.1	41.3	3.0	107.7	13.0	8.8	17.7

The seven soil constrain groups include::

#1 water erosion hazard rating of severe; #2 slopes greater than 15%; #3 less than 15 inches to bedrock; #4 seasonal high water table within 6 feet of the soil surface; #5 particle size greater than or equal to 2 mm in diameter (15 to 35% by volume of rock fragments).; #6a electrical conductivity of a saturated extract greater than 4 µmhos/cm; #6b pH of 8.5 or greater; #7 shrink/swell potential of moderate or high

Source: NRCS 1980a, NRCS 1980b, NRCS 1989, NRCS 1992, NRCS 1997, NRCS 1998, and EDAW 2000

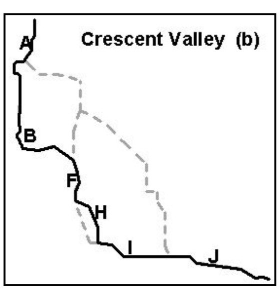
Crescent Valley (a) Route Alternative



Crescent Valley (a) includes Segments A, B, F, G, I, and J. Crescent Valley (a) is approximately 185.9 miles long. Within the route alternative, the following soil constraints would be encountered: 106.7 linear miles of coarse to very coarse soil textured soils, 55.5 linear miles of soils with slopes greater than 15%, 17.1 linear miles of saline soils, 9.6 linear miles of alkaline soils, 4.4 linear miles of soils with high water table, 28.3 linear miles of soils with high shrink/swell potential, 14.8 linear miles of soils with a high water erosion hazard rating, and 29.7 linear mile of soils with shallow depth to bedrock. Approximately 56.2 linear miles (30%) of the Crescent Valley (a) route alternative have no reclamation constraints (i.e., are generally not characterized by any of the seven soil constraint groups). Note that this route alternative has the highest mileage of soils with a high water table.

Construction, operation, and maintenance of project can result in impacts described in Impacts Soil-1 through Soil-4; these adverse impacts, though less-than-significant, will be reduced by implementing Mitigation Measures Soil-1 through Soil-4.

Crescent Valley (b) Route Alternative

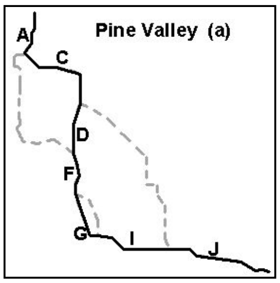


Crescent Valley (b) includes Segments A, B, F, H, I, and J. Crescent Valley (b) is approximately 186.4 miles long. Within the route alternative, the following soil constraints would be encountered: 112 linear miles of coarse to very coarse soil textured soils, 55 linear miles of soils with slopes greater than 15%, 17.5 linear miles of saline soils, 10.9 linear miles of alkaline soils, 4.1 linear miles of soils with high water table, 29.8 linear miles of soils with high shrink/swell potential, 12.3 linear miles of soils with a high water erosion hazard rating, and 27.5 linear mile of soils with shallow depth to bedrock. Approximately 49.3

linear miles (26%) of the Crescent Valley (b) route alternative have no reclamation constraints (i.e., are generally not characterized by any of the seven soil constraint groups). Note that this route alternative has the highest mileage of soils with coarse soil texture, saline soils, alkaline soils, and high shrink/swell potential, as well as the least mileage of soils with a high water erodibility or steep slopes.

Construction, operation, and maintenance of project can result in impacts described in Impacts Soil-1 through Soil-4; these adverse impacts, though less-than-significant, will be reduced by implementing Mitigation Measures Soil-1 through Soil-4.

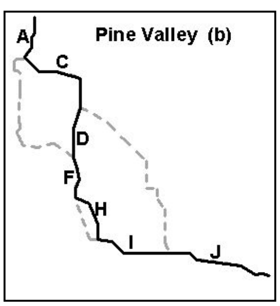
Pine Valley (a) Route Alternative



Pine Valley (a) includes Segments A, C, D, F, G, I, and J. Pine Valley (a) is approximately 179.1 miles long. Within the route alternative, the following soil constraints would be encountered: 93.6 linear miles of coarse to very coarse soil textured soils, 58.7 linear miles of soils with slopes greater than 15%, 16.3 linear miles of saline soils, 8.5 linear miles of alkaline soils, 3.3 linear miles of soils with high water table, 25.2 linear miles of soils with high shrink/swell potential, 24.1 linear miles of soils with a high water erosion hazard rating, and 29.7 linear mile of soils with shallow depth to bedrock. Approximately 57.7 linear miles (32%, the highest constraint-free mileage of any route alternative) of the Pine Valley (a) route alternative have no reclamation constraints (i.e., are generally not characterized by any of the seven soil constraint groups). Note that this route alternative has the highest mileage of soils with high water erodibility, as well as the least mileage of soils with coarse texture and alkaline soils.

Construction, operation, and maintenance of project can result in impacts described in Impacts Soil-1 through Soil-4; these adverse impacts, though less-than-significant, will be reduced by implementing Mitigation Measures Soil-1 through Soil-4.

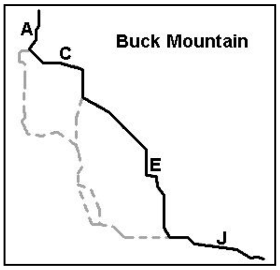
Pine Valley (b) Route Alternative



Pine Valley (b) includes Segments A, C, D, F, H, I, and J. Pine Valley (b) is approximately 179.5 miles long. Within the route alternative, the following soil constraints would be encountered: 99 linear miles of coarse to very coarse soil textured soils, 58.3 linear miles of soils with slopes greater than 15%, 16.7 linear miles of saline soils, 9.8 linear miles of alkaline soils, 3 linear miles of soils with high water table, 26.7 linear miles of soils with high shrink/swell potential, 21.6 linear miles of soils with a high water erosion hazard rating, and 27.4 linear mile of soils with shallow depth to bedrock. Approximately 50.8 linear miles (28%) of Pine Valley (b) have no reclamation constraints (i.e., are generally not characterized by any of the seven soil constraint groups). Note that this route alternative has the lowest mileage of soils with shallow depth to bedrock and high water table.

Construction, operation, and maintenance of project can result in impacts described in Impacts Soil-1 through Soil-4; these adverse impacts, though less-than-significant, will be reduced by implementing Mitigation Measures Soil-1 through Soil-4.

Buck Mountain Route Alternative



Buck Mountain includes Segments A, C, E, and J. Buck Mountain is approximately 167.3 miles long. Within the route alternative, the following soil constraints would be encountered: 107.7 linear miles of coarse to very coarse soil textured soils, 60.1 linear miles of soils with slopes greater than 15%, 13 linear miles of saline soils, 8.8 linear miles of alkaline soils, 3 linear miles of soils with high water table, 17.7 linear miles of soils with high shrink/swell potential, 21.7 linear miles of soils with a high water erosion hazard rating, and 41.3 linear mile of soils with shallow depth to bedrock. Approximately 30.5 linear miles (18%, the lowest constraint-free amount of any of the route alternatives) of Buck Mountain have no reclamation constraints (i.e., are generally not characterized by any of the seven soil constraint groups). Note that this route alternative has the highest mileage of soils with steep slopes and shallow bedrock, as well as the least mileage of soils with high water table, saline soils, and high shrink/swell potential.

Construction, operation, and maintenance of project can result in impacts described in Impacts Soil-1 through Soil-4; these adverse impacts, though less-than-significant, will be reduced by implementing Mitigation Measures Soil-1 through Soil-4.

Summary Comparison of Route Alternatives

TABLE 3.2-3: SUMMARY COMPARISON OF IMPACTS BY ROUTE ALTERNATIVE

Impact	Crescent Valley (a)	Crescent Valley (b)	Pine Valley (a)	Pine Valley (b)	Buck Mountain
Impact Soil-1: Increased Soil Compaction and Rutting in the Transmission Line Corridor and Around Substations During Construction, Operation, and Maintenance of the Project	X	X	X	X	X
Impact Soil-2: Delayed or Reduced Reclamation Success Due to Project Activities on Coarse to Very Coarse Textured Soils, Alkaline/Saline Soils, or Soils with Shallow Depth to Bedrock	X	X	X	X	X
Impact Soil-3: Construction on Expansive Soils (High Shrink/Swell Potential)	X	X	X	X	X
Impact Soil-4: Increased Soil Erosion in the Transmission Line Corridor and Associated Facilities During Construction, Operation, and Maintenance of the Project	X	X	X	X	X

RESIDUAL IMPACTS

After mitigation and reclamation, residual impacts related to soils would be minor. Residual effects to soils would result primarily from temporary disturbances to soils and removal or reduction of vegetation. After reclamation, these impacts should minimal.

NO ACTION ALTERNATIVE

Under the No Action Alternative, impacts to existing soils resources associated with this project would not occur. However, soils-related impacts could occur in other areas as SPPC and the Nevada PUC would begin emergency planning efforts to pursue other transmission and/or generation projects to meet the projected energy shortfall.